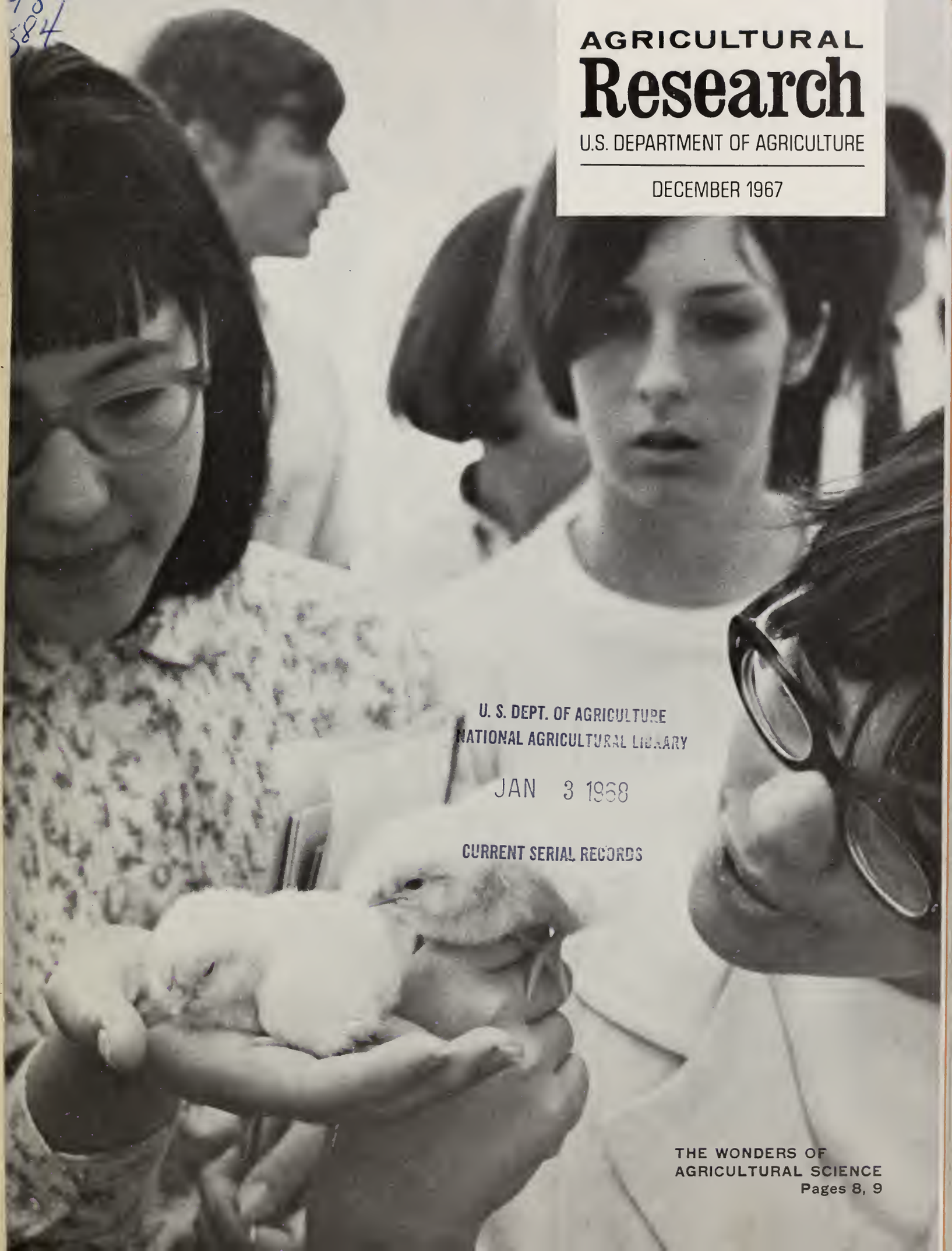
AGRICULTURAL
Research
U.S. DEPARTMENT OF AGRICULTURE

DECEMBER 1967



THE WONDERS OF
AGRICULTURAL SCIENCE
Pages 8, 9

AGRICULTURAL
Research

December 1967/Vol. 16, No. 6

AG Science Week

"Agriculture 2000: Agricultural Science in the Service of Man," was the theme of the Open House held by 30 ARS stations across the nation the last week in September.

Open House was a good way to tell the story of agricultural science, for adults and children alike were able to see for themselves the exciting things that scientists are doing to make life a little better (p. 8, 9).

The housewife had a firsthand look at what science is doing behind the scenes to assure that the fruits and vegetables she buys arrive in her kitchen almost as fresh as the day they were harvested. Homeowners, plagued by brown lawns, saw relief in sight through advances in nematode control in soils.

Who else came? Fellow scientists who asked highly technical questions; little children, who, for the first time, saw chicks being hatched; high school students, who pored over the literature and visited the laboratories or exhibits, and asked many intelligent questions of the scientists.

If the spectator came to view science fiction-like achievements, there was the story of food supply monitoring by satellite. Or perhaps the more imaginative visitor was thrilled by the ways in which scientists can control the population of insect pests by radiological or biological means.

It was good to have these visitors and know that they were pleased with what they saw, but even more important, people gained some understanding of the increasingly important role of agricultural research. Open House was an important step toward bringing about inter-relationships between ARS scientists and the people they serve.

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AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), United States Department of Agriculture, Washington, D.C. 20250. Printing has been approved by the Bureau of the Budget, June 1967. Yearly subscription rate is $1.50 in the United States and countries of the Postal Union, $2.00 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Orville L. Freeman, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

Cool Headed Cows

...for better milk production

COWS THAT KEEP "cool heads" during long, hot summers give more milk than cows that don't.

In tests, cows gave 15 to 20 percent more milk when their heads and necks were held in enclosures cooled to 60° F. than when they were housed in an 85-degree barn.

This ARS study on the effects of various temperatures on milk production in hot climates was conducted by agricultural engineer LeRoy Hahn, in cooperation with the University of Missouri, Columbia.

Previous ARS research shows that cool, pleasant environments have a beneficial effect on milk production. Most dairymen hesitate to air condition their barns, however, because of high installation, operating and maintenance costs.

Reduced cost is the main advantage of cooling only cows' heads and necks to increase milk production. It is less expensive to cool a relatively small enclosure than to air condition an entire barn. Moreover, cooling only the air within the enclosure presents no dust, odor, or ammonia accumulation problems—as are associated with recirculated air—since ventilating fans can operate normally in the rest of the barn.

Hahn became interested in this alternative to total air conditioning after learning that "zone" or "snout" cooling had increased hog production. His tests were carried out in the Missouri Climatic Laboratory on the Univer-

Cow with head in air-conditioned enclosure made of plywood. Flexible canvas seal has enough "play" in it to allow cow to stand or lie down (PN–1565).

sity campus.

To measure the effects on milk production of cooling cows' heads and necks and providing them with cool air to breathe, Hahn first determined milk production levels of 10 Holstein cows by placing them in a room cooled to 65 degrees. He then confined the cows with their heads and necks in individual air-conditioned enclosures. Temperatures within the enclosures could be varied from that of the overall room. During all tests room temperature was 85 degrees.

By regulating the temperature in the enclosures, Hahn learned:

- When cows breathed air the same temperature as the room, milk production declined to 75 percent of what it was when cows were in the 65-degree environment.
- When cows breathed air cooled to 60 degrees, milk production was 91 percent of normal.
- When cows breathed air cooled to 50 degrees, milk production was 90 percent of normal.

The study was specifically aimed at increasing milk production at a time when the number of milk cows in the United States is decreasing and the world population is increasing. It is a part of ARS' continuing effort to find new and less expensive ways of producing food and fiber to meet spiraling future demands.■

Rear view of head enclosures, showing flexible seals around cows' necks. Room temperature outside enclosure is about 85° F. (PN–1566).

Answer to Dairy Plant Cleaning?

A SYSTEM FOR CLEANING dairy plant processing equipment without taking it apart has been developed by ARS researchers at Columbia, Mo. Although it is still in the testing stage, it has been accepted by the Missouri Health Department for use in the University of Missouri plant.

The greatest advantage of the CIP system (cleaned in place) is labor saving. Many processing plants hire several men primarily for the cleanup period which may take as much as 2 hours. The rest of the time much of this labor is surplus. One man can handle the automated cleanup system developed by ARS agricultural engineer M. E. Anderson, and associate professor R. T. Marshall, and instructor D. S. Shelley, both with the University of Missouri's Department of Food Science and Nutrition.

Another advantage of the CIP system is a reduction in inevitable dents, scratches, and general wear and tear that come with taking equipment apart daily. The volume of processing could also increase because downtime is reduced about 50 percent.

Anderson developed the system to make fully automatic cleanup of the processing lines possible. The entire system must be cleaned as one unit. This means intricate equipment such as the flow diversion valve and homogenizer timing pump must be cleaned with the processing line. Five pumps in the system had to be coordinated to maintain equal pressure throughout the system at two speeds. A slow speed is used for milk processing and a faster speed for the cleaning to get better cleaning action.

The CIP system consists of several electrical-mechanical units controlled by a programed cam timer. The electromechanical units are an alkali tank water makeup unit, an alkali tank temperature control unit, an alkali detergent feeder and several selector switches, position switches, relays, and timers.

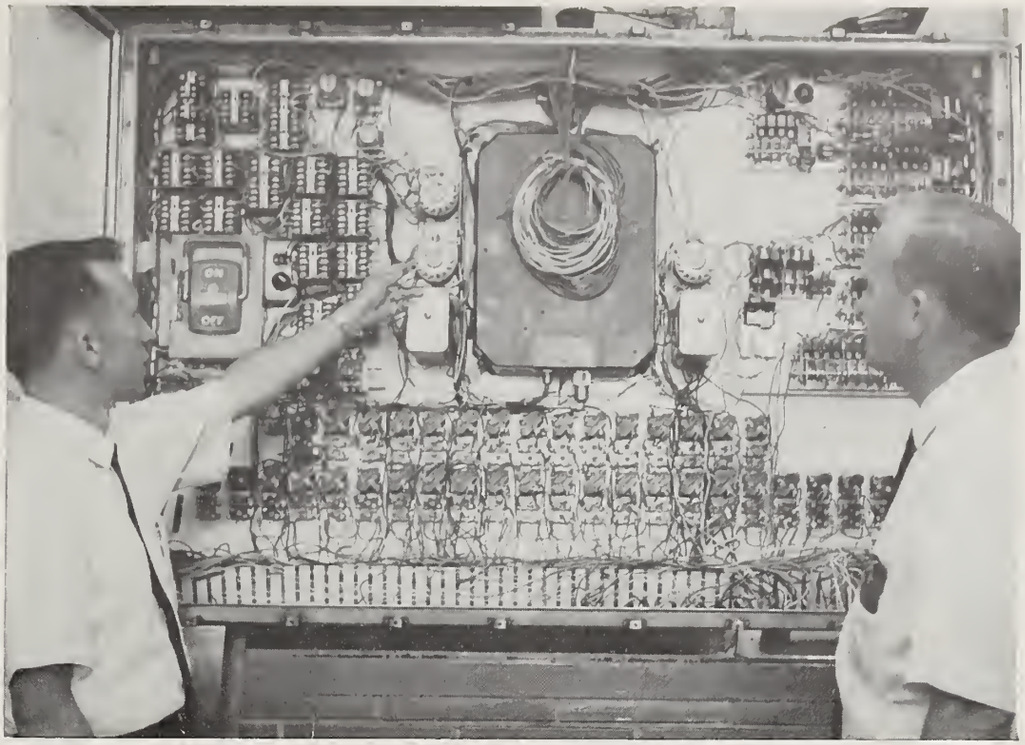
The automated system fills the wash tank with water, heats it to between 115—125° and adds the required amount of cleaning compound. The wash water is then pumped through the line to clean a milk storage tank or processing line or both. The temperature of the wash water and the amount of cleaning compound in the wash water are automatically maintained throughout the cleaning cycle.

The electrical conductivity of the wash water gives a measure-

University of Missouri plant processing supervisor Ralph Floyd with valves that control milk and wash water flow in dairy processing plant (PN–1567).

ment of the amount of active detergent remaining, so more can be automatically added if necessary.

The system is being tested under production conditions in the dairy plant at the University of Missouri. Some of the developments of this project may be applicable to the dairy farm and other food processing facilities as well as dairy processing plants.■



Microbiologist R. T. Marshall, left, and agricultural engineer M. E. Anderson, inspect rear of pushbutton panel that programs entire CIP operation (PN–1568).

a "GOOD HOT BATH" for Nematode Control in Sod

A GOOD, HOT BATH will free turf from at least three types of nematodes. In tests at Tifton, Ga., nematologist C. M. Heald and plant pathologist H. D. Wells eradicated nematodes from turf held in water at 55° C. (131° F.) for 15 minutes. There was no damage to the turf.

In the past, hot-water treatments have successfully controlled nematodes in many plants, including strawberries, citrus nursery stock, and sweetpotatoes. But for turf treatment, scientists could not rely on available information because different nematode species die at different temperatures. Also, in turf the nematodes are somewhat insulated from the hot water. The ARS scientists point out that, if the method is to be used commercially, temperature and time interval adjustments may have to be made for different sizes of turf.

In the experiment, cores of Tifgreen and Tifdwarf bermudagrass from turf plots infested with three nematode species—*Criconemoides*, *Hypsoperine*, and *Tylenchorhynchus*—were held for different lengths of time in water at various temperatures. A control group of cores was kept in water at 21° C. for 45 minutes.

After the heat treatment, the cores were planted in clay pots filled with sterilized sandy loam and placed in a greenhouse for a period of observation. They were allowed to grow for 4 months. Then they were taken from the pots, and the nematodes were separated from the soil for counting with a centrifuge. Also, samples of the roots were incubated for 48 hours, and the nematodes were then collected and counted.

One problem the scientists faced was finding the narrow range between nematode kill and plant injury.

The tests show that nematode populations will be drastically reduced—but not wiped out—when cores are held for 15 minutes in water at 50° C. Holding cores for 15 minutes at 60° C. kills both nematodes and grass. At the optimum time-and-temperature combination of 15 minutes at 55° C., the hot water causes no damage to the turf, germination is not impeded, and all the nematodes are killed.

Heald and Wells point out that nematodes cause considerable damage to turf and can spread to many locations in turf shipments. Test results show that hot-water treatments could help to establish nematode-free turf and to greatly reduce the spread of nematodes in shipments of sod cores.■

GERM PLASM *for the* UNITED STATES

SECRETARY FREEMAN, in the foreword to the 1961 Yearbook of Agriculture wrote: "Seeds are ever a positive and creative force. Seeds are the germ of life * * * the fruit of yesterday's harvest and the promise of tomorrow's." For new crops and additional breeding stocks for crops already established, the United States is largely dependent on other parts of the world.

Under Public Law 480 research grants for germ plasm collection projects, scientists in Asia, the Middle East, Europe, and South America have forwarded thousands of seed and plant samples to the United States to be evaluated—particularly for oils, proteins, nonstarch carbohydrate gums, tannins, fibers, waxes, and other industrially used constituents. These samples also include species that might have anticancer agents and other medicinal properties.

Under a 5-year grant awarded in 1960 to the University of Ankara, Turkish botanists collected 1,420 samples of seed, whole plant, root bulb, and stem for ARS analysis. By 1964, chemical analysis of 1,023 seed samples indicated that 895 species were distinguished by either high oil or high protein content or by superior, combined protein-oil contents.

Among the 91 botanical families surveyed in Turkey, the following were found the most promising: Sunflower, Mustard, Mint, Snapdragon, Carrot, Spurge, Buttercup, Herb (Borage), Rose, Nightshade, Bean, Teasel, Poppy, Rue, Staff Tree, Milkweed and Mallow.

The University of Ankara also sent 37 samples of root, bulb, rhizome, stem, and inflorescences of 5 species which exhibited antitumor activities in our Anti-Cancer Screening Program, as well as germ plasm from 163 varieties for improvement breeding of existing U.S. crops.

Among the 17 families noted above, 11 species contain oils not previously known to occur in nature. Some have unusually long carbon chains or superior hydrogen and oxygen groupings—properties which could lead to wider industrial uses.

New drug crops for the United States present another fascinating aspect of the germ plasm projects under Public Law 480. Organic chemists at the University of Antioquia in Colombia, worked 4 years surveying and screening the potato family of plants from which steroid alkaloids may be obtained. These are the starting chemicals from which cortisone, sex hormones, and other related drugs are made.

Pakistani scientists at Gordon College, Rawalpindi, also collected plants for drug screening in the United States. They provided 12 species possessing antitumor characteristics. Between 1962 and 1966, Pakistan sent 692 seed and fruit samples to ARS' New Crops Research Branch.

Scientists at the Faculty of Agronomy, Montevideo, Uruguay, worked 5 years screening native plants there, as well as in adjacent Argentina, Brazil, and Paraguay. Fifteen seed samples collected for the United States possessed unusual fatty acid composition, and preliminary tests of 14 species revealed sufficient antitumor activity to warrant additional testing.

Under a 5-year grant in Spain, researchers at the National Institute of Agronomical Investigations, Madrid, sent to ARS seed samples of 606 botanical species belonging to 55 families along with 291 samples of whole plant material. Both seed and plant samples provided by this project have yielded a number of potentially valuable leads. Seed from a species of the Spurge family, for example, has an oil and epoxy acid content which affords important considerations for industrial use. In addition, samples of 5 plant species from Spain are now confirmed actives in the NIH–ARS anticancer program.

Dr. Quentin Jones, New Crops Research Branch, Beltsville, Md., is the sponsoring scientist in the United States for these Public Law 480 projects.■

Public Law 480 grants are paid for with foreign currency obtained by the United States from sales of farm products abroad. This money cannot be converted into dollars for use in the United States.

Virtanen to present Atwater Lecture

SECRETARY FREEMAN has announced the selection of Dr. Artturi I. Virtanen, Nobel Prize winning Finnish chemist, to present the first in a series of lectures sponsored by the U.S. Department of Agriculture.

This lecture will be given in April 1968, at Atlantic City, N.J. before the Federation of American Societies for Experimental Biology and will honor USDA's first chief of human nutrition research, Dr. Wilbur O. Atwater (1844–1907).

Dr. Virtanen, Director of the Biochemical Institute in Helsinki, has directed much of his research toward improving human nutrition. He was awarded the Nobel Prize for chemistry in 1945 for his investigations and discoveries in agricultural and nutritional chemistry.

Under Public Law 480 grants Dr. Virtanen has been the principal investigator of studies concerning the relationship between biologically active feed compounds and flavor in dairy cattle milk and of studies concerned with chemical and physiological information on enzyme products in plants.

In the course of his investigations Dr. Virtanen has also proved that superior milk production in dairy cows can be achieved by using a diet of little grain, inferior roughage, and urea to replace most of the protein in conventional rations.■

(*PN–1580*).

SCHOOL LUNCHES MEET GOALS

THE NOON MEALS served to children through the National School Lunch Program meet goals set up by the U.S. Department of Agriculture for calories, proteins and calcium.

This is the conclusion of researchers who studied collections of lunches served at 300 schools in 19 States during the 1966–67 school year to help ARS nutritionists evaluate the Type A lunch pattern.

The school lunch program was set up in 1946 to provide attractive, moderately priced lunches furnishing one-third of a child's daily food needs while permitting enough leeway in menus to suit the tastes found in the varied school situations throughout the country.

Tests show that the average lunch served to sixth graders had an energy value of 735 calories. (This group was chosen because the Type A lunch pattern is based on nutritutional needs of 9- to 12-year-old children.) This almost exactly meets the goal for girls of this age and falls only slightly short of the 800 calories specified for boys. Many schools make extra foods or second helpings available, thus enabling the boys to bring the energy value of their lunches up to standard.

Only a few schools served lunches too small to provide the desired levels of calories and calcium, while several averaged more than 1,000 calories per meal. Although this may be high for children getting good meals at home, it is not excessive for those who have only the one substantial meal a day.

All of the schools served lunches exceeding the goal for protein, while calcium in the average lunch was rated about 10 percent higher than the standard for that nutrient.

Further evaluations are being made to determine the vitamin content, certain minerals other than calcium, and fatty acids. These will provide ARS food specialists with an excellent measure of the way Type A school lunches are meeting nutritional goals.

The study is being conducted by the Consumer and Food Economics Research Division in ARS which planned the project and is evaluating the data; the Wisconsin Alumni Research Foundation, which is doing the laboratory analyses; and the State school lunch agencies and the School Lunch Division of Consumer and Marketing Service which supervised the collection of lunches.■

The chicks and hatching exhibits at Beltsville, Md., fascinated the children, some of whom had never seen a farm animal before. Seeing and learning how to hold a chick was, in itself, an educational experience (ST–3005–2).

At the taste testing booth, Beltsville researchers asked the question, "What makes a steak tender?" They broiled several hundred pounds of meat and provided taste samples to prove they knew the answer (ST–3017–8).

Agricultural Science in the Service of Man

OPEN HOUSE ...Nationwide

CHICKS AND LAMBS fascinated the children.

Bread and steak samples delighted the students.

Greenhouses and gardening tips attracted their parents.

And they all learned that modern agriculture is more than plowing a field. They learned, too, that agricultural research is a sophisticated enterprise employing scientists, engineers, and technicians from many disciplines.

Some 30 ARS and State research facilities throughout the country held Open House during National Agricultural Science Week, Sept. 24–30. The public was invited to demonstrations, exhibits, and guided tours through the laboratories.

More than 20,000 visitors at the Beltsville, Md., Center, the largest agricultural research complex in the world, saw how scientists change the color of flowers and how insect pests are destroyed without chemicals. They saw the famous fatherless turkeys and the calves raised on synthetic diets. And they saw how space satellites can monitor our food supply.

They were amazed at the contrast in growth between plants from a greenhouse and plants from a specially designed growth chamber and they were interested in the large jeweled beetles intercepted by the Plant Quarantine Division.

The kids thought the way scientists pulled blood out of a plastic pig was ingenious, and picking mushrooms in the mushroom laboratory was a new experience.

The public enthusiasm for learning more about modern agriculture, the interest of students in new and experimental agricultural techniques, and the eagerness of the scientists to tell their story—all combined to make the nationwide Open House a tremendous success.■

Also at Beltsville, technician M. F. Combs explains the seed vibrator-separator, a machine that can separate two different types of seeds—weed seeds from grass seeds, for example. The board is tilted and has a rough surface. When vibrated, rough-sided seeds migrate up the slope while the smooth seeds run down and drop off at the bottom. This machine is one of the first designed specifically for seed testing (ST–3012–17).

Entomologist G. P. Markin discusses the fire ant, a pest from South America that threatens crops in the South and West, at the Plant Pest Control Fire Ant Laboratory, Gulfport, Miss. Fire ant control workers are now using radio-guided planes to mark spraying courses for more thorough coverage (PN–1578).

Entomologist J. H. Brower demonstrates the package irradiator in the grain irradiation building at the Stored-Products Insects Laboratory, Savannah, Ga. This machine may eventually enable scientists to control insects and molds in stored grains and processed foods with radiation (PN–1579).

Horticulturist J. K. Stewart at the Market Quality Research Laboratory, Fresno, Calif., shows how lettuce is vacuum-cooled to help keep it fresh during shipment East (PN–1576).

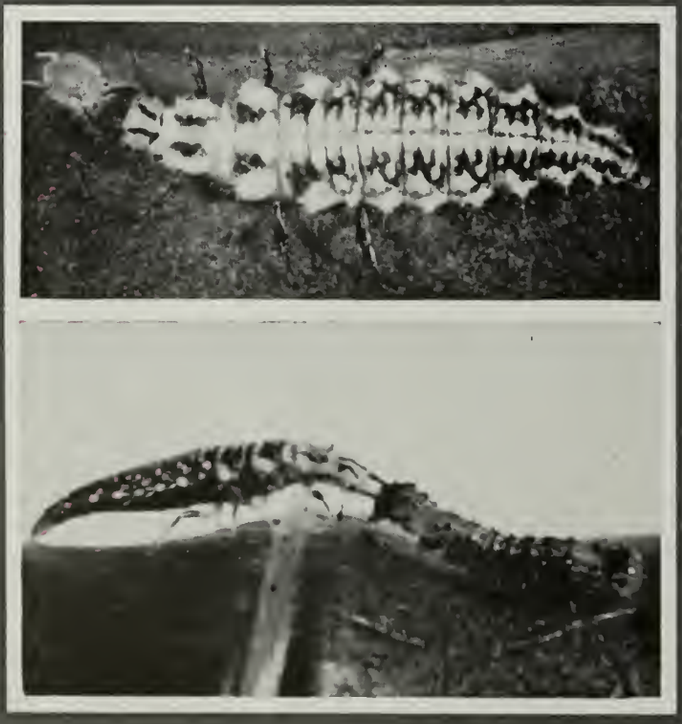
At the Yakima, Wash., laboratory, entomologist D. O. Hathaway describes methods of rearing the codling moth, a destructive pest of apples, pears, and other fruit. The jars in front of Hathaway contain emerging moths. Eggs lie on the white paper in the foreground. The moths are sterilized and then released to mate with the natural population. No offspring result from these matings, and moth populations are radically reduced (PN–1577).

Horticulturist F. E. Gardner of the Horticultural Field Station, Orlando, Fla., explains the citrus virus exhibit to the Ha Grapefruit Queen and the Florida Citrus Queen. The Florida researchers are work to control the citrus virus, which can reduce yield and quality of fruit as well as kill (PN–1574).

Chemist G. W. Engstrom (right) explains chemistry equipment to a group of Open House visitors at the National Animal Disease Laboratory, Ames, Iowa (PN–1575).

APHID LION...

Ally in Cotton Insect War

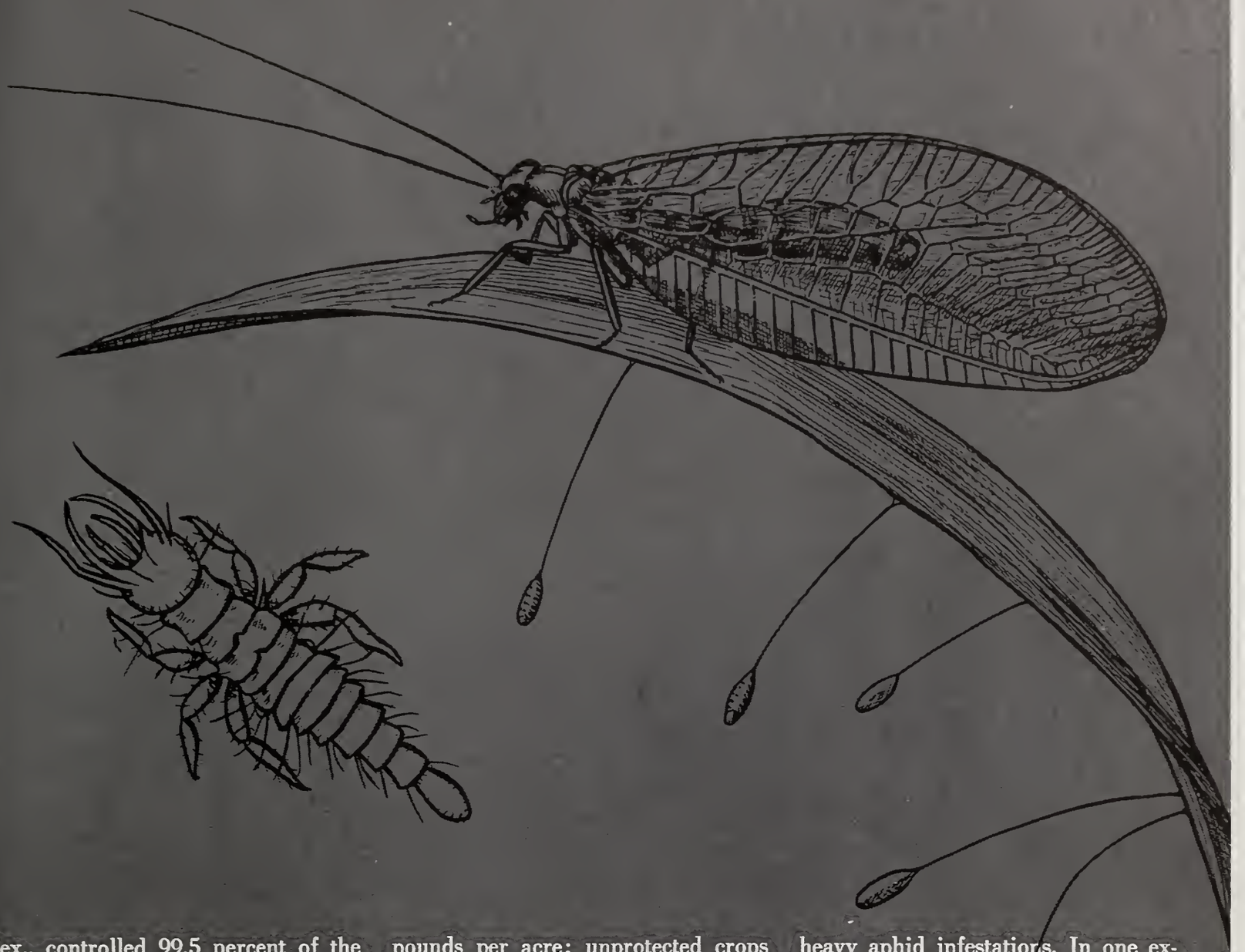


Top photo: *Aphid lion (lacewing larva) sucking body fluids from an aphid.* Bottom: *Aphid Lion attacking bollworm.* Opposite page: *Lacewing and larva. Adult on leaf is with eggs. Stalks attached to eggs prevent cannibalistic newly hatched young from eating their brothers and sisters (TX–593, PN–1569, PN–1570, BN–30886, BN–10060).*

As BOLLWORMS BECOME increasingly resistant to available insecticides, scientists are searching for insect predators to help control them and several other pests of cotton.

They have found that aphid lions not only have an appetite for destructive cotton insects, but are also resistant to some of the best systemic insecticides, such as Azodrin and UC–21149. Aphid lions, the larvae of the green lacewing, *Chrysopa carnea*, are so named because they were first found preying on various aphid species.

Entomologist R. L. Ridgway and agricultural research technician S. L. Jones, of the ARS Cotton Insects Research Laboratory, College Station,



Tex., controlled 99.5 percent of the bollworms in cage tests by releasing aphid lions at a rate of 25,000 per acre—a level of control equal to the best obtainable with conventional insecticides.

In related tests, Ridgway and Jones reduced cotton boll injury caused by bollworms to a mere 3 percent by releasing aphid lions at a rate of 92,000 per acre in late June and 200,000 more per acre, 6 days later in small, field test plots. Again, results were as good as could be obtained with the best available insecticides. Damaged bolls in untreated check plots averaged 44 percent.

Seed cotton yields of crops protected by the aphid lions averaged 1,200 pounds per acre; unprotected crops averaged 400 pounds.

The Texas Agricultural Experiment Station cooperated in the ARS tests.

Aphid lions would ideally fit into an integrated control program. First, early season cotton pests, such as aphids, boll weevils, fleahoppers, lygus bugs, and spider mites, would be controlled with a systemic insecticide which is absorbed by all plant parts through soil or stem applications. A few weeks later the predators would be released to fight bollworms.

Cotton aphids are also part of the aphid lion's diet; and this somewhat reduces the predator's feeding on bollworms. However, Ridgeway and Jones obtained promising results even under heavy aphid infestations. In one experiment, they found that the searching behavior of the aphid lions leads them most often to favorite feeding and hiding places of the bollworms, thereby favoring decimation of bollworms over aphids.

In further research, scientists will determine numbers of aphid lions needed for bollworm control and the best intervals for release of the predators.

Tests are also needed to develop mass rearing methods to ensure a dependable supply of aphid lions. Larger field tests of releases will also yield information on the effects of the aphid lions on succeeding generations of bollworms.■

Turkey Can Be Roasted . . frozen or thawed

WITH TURKEY NOW available in almost any reasonable size—or in halves, quarters, or smaller cut-up pieces—the homemaker has a wide choice in method of preparation. Whether she is a single girl serving her first dinner in an efficiency apartment or a grandmother with her large family gathered around on Christmas Day, she can benefit from ARS research on turkey preparation.

Several possibilities are open. The turkey can be roasted by dry heat on a rack in an open pan, cooked in a covered pan, wrapped in aluminum foil, covered in foil lightly crimped to the pan edges, covered loosely with a foil tent throughout the cooking period, or covered with foil only long enough to prevent too much browning.

Unless one raises turkeys or buys direct from a farmer or market, the turkey in question will probably arrive in the kitchen frozen. The unstuffed turkey can then be put in the oven frozen or thawed before cooking. Frozen whole or cut-up turkey yields as much meat and tastes just as good when cooked without thawing, according to members of a taste panel who sampled the meat in ARS nutrition laboratories. The giblets were packaged separately from the whole turkey rather than inside the body cavity.

It takes about 2¼ hours longer to roast a frozen whole unstuffed turkey weighing about 20 to 24 pounds than an unstuffed turkey that has been thawed. Average cooking time was reduced 25 to 63 percent by cutting the turkey into pieces, quarters or halves, with frozen cut-up turkey taking ½ to ¾ hour longer to cook than thawed cut-up turkey. The taste panel judged palatability of cut-up turkey as good or better than that of whole turkey.

ARS food specialists say 185° F. is the most desirable end temperature for whole and cut-up turkey roasted from either the frozen or thawed state. The temperature should be measured in the thickest part of the inner thigh, or in the thickest part of the breast or pieces without thigh. The accompanying table shows the time necessary to cook the various turkey forms, using an oven temperature of 325° F.

It is most important to see that the turkey does not remain too long in the temperature range of 50° to 120° F., considered to be the most conducive to growth and development of food poisoning organisms. The period during which the turkey's internal temperature falls within this range should never exceed 4 hours. Roasting at the suggested temperature of 325° F. assures that the turkey will not be in this temperature range too long.

If the frozen turkey comes from the store complete with dressing, it must not be thawed before cooking. And the temperature of the stuffing itself should reach at least 165° F. (test by inserting thermometer in body cavity for about 5 minutes after turkey comes from oven). If the reading is not at least 165° F., return to oven and continue roasting until the proper temperature is reached. Roasting time for frozen stuffed turkey as given on the package is longer than for the unstuffed turkeys in the accompanying timetable. ■

Average Roasting Times

For whole, halves, quarters, and pieces of frozen or thawed turkey [1]

Form of turkey	Times in hours required to reach internal temperature of 185° F.[2]			
	Cooked from frozen state		Cooked from thawed state	
	Mean	*Range*	*Mean*	*Range*
Whole turkeys (unstuffed)	7.0	6.4–7.6	4.8	4.5–5.3
Turkey halves	4.1	3.3–4.6	3.4	2.6–3.9
Turkey quarters:				
Breast quarters (light meat)	3.8	3.2–4.3	3.2	2.6–3.6
Leg quarters (dark meat)	2.9	2.6–3.3	2.2	1.6–2.7
Turkey pieces:				
Breast	4.1	3.8–4.4	3.6	3.1–4.3
Leg	2.6	2.4–2.9	1.9	1.7–2.1

[1] Using an oven temperature of 325° F.
[2] Average for whole 20- to 24-pound turkeys and other forms cut from 20- to 24-pound turkeys.

SCIENTISTS STUDY

GRAIN STRESSES

WHAT STRESSES CAUSE grain to crack? ARS researchers at Manhattan, Kans., are trying to find out so they can find ways to reduce the stress and thereby the resulting cracking and loss of market quality.

The problem was brought into focus a few years ago when the Soviet Union bought a large quantity of Canadian wheat in preference to U.S. wheat because of quality differences. The main criticism was that U.S. wheat contained many damaged or cracked kernels; the same problem exists with exported corn, soybeans, and other grains.

In a cooperative effort with Kansas State University, ARS is studying environmental changes, and the physical harvesting and handling procedures which grains undergo.

Although the work is still in the early stages, the researchers, Kansas State University chemical engineer D. S. Chung, and ARS agricultural engineer H. H. Converse, have found differences between grain varieties in their susceptibility to cracking.

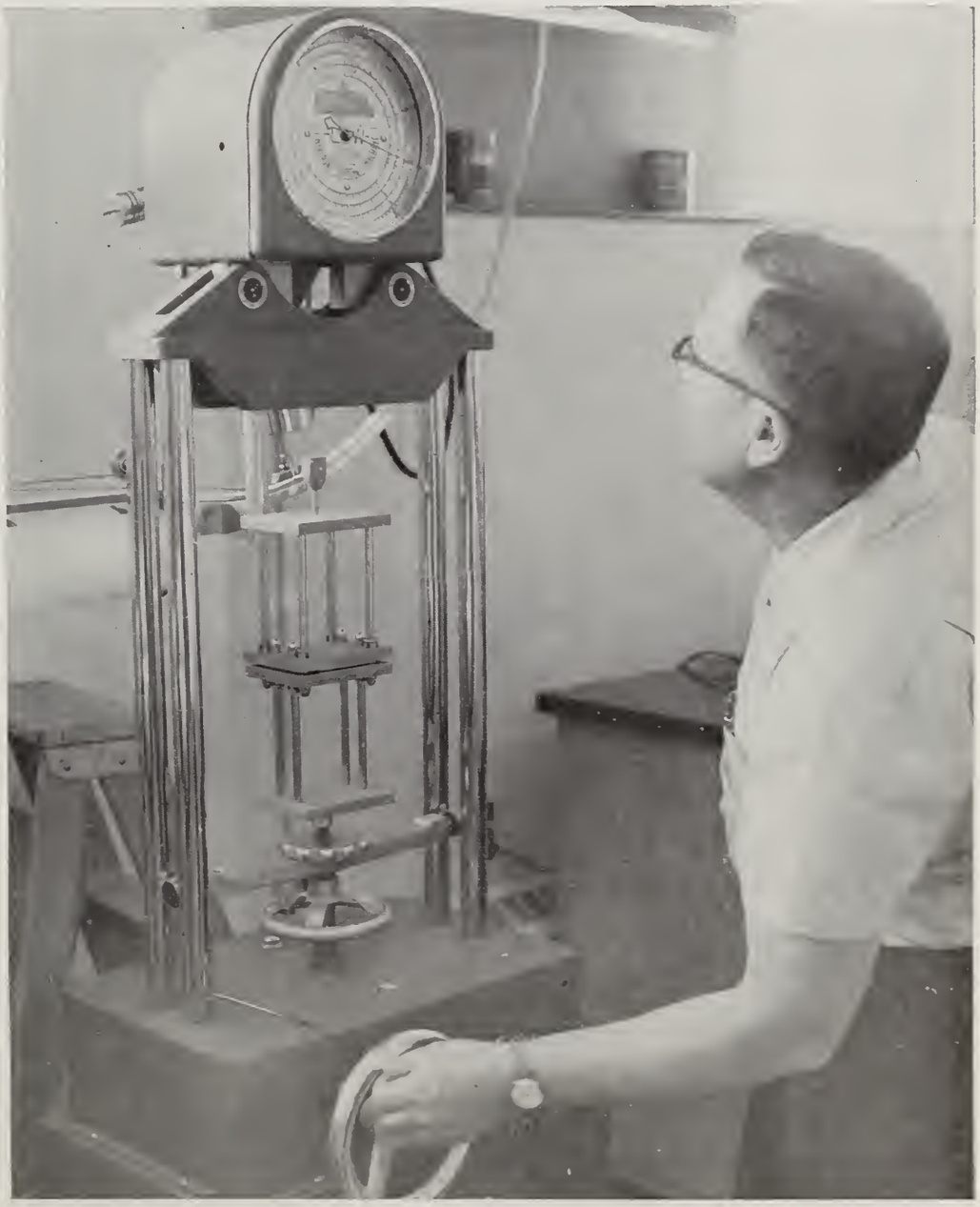
By evaluating grain with X-ray negatives, the researchers can detect internal cracking which may result from stresses such as rapid and significant changes in moisture levels or from rough treatment in harvesting or handling equipment.

Chung and Converse found that kernels of hand-harvested grain sustained internal cracking even though they had never been touched by mechanical equipment. In cases of prolonged wet weather and delayed harvest, such as occurred in much of the wheat belt last summer, the researchers found a much higher percentage of kernels showing internal cracking before harvest than in the previous year.

The researchers are also subjecting kernels to measurable pressures to see how much they can tolerate before cracking. The tolerance point relates to grain moisture content and temperature as well as inherent physical properties of the grain variety.

Results of the study should help engineers, designers, and manufacturers to produce better grain harvesting and handling equipment. It should also help farmers and elevator operators do a better job of using harvesting and handling equipment to move better quality grains to market.■

ARS agricultural engineer H. H. Converse checking pressure testing device in which a kernel of corn has been placed to test breaking pressure (PN–1571).



Which Grain Concentrate is Best for

FINISHING STEERS?

RECENT ARS TRIALS show that all-concentrate rations of cracked corn, barley, or wheat fortified with urea gave results superior to milo or unfortified corn for finishing steers.

Metabolism tests showed that steers were unable to digest and retain nutrients as readily from corn or milo without urea as from barley or wheat.

Urea-fortified corn was equivalent to barley or wheat, but a similar urea supplement did not raise the feeding value of milo.

Beef cattle nutritionist R. R. Oltjen, who led the trials, says many cattle feeders are finishing steers on rations with corn, wheat, barley, milo, or combinations of these grains as the major energy source. Since many of these cattlemen do not raise grain, they are constantly faced with the problem of determining the best feed buy.

The grains Oltjen used in his comparison trials were supplemented with minerals, vitamins, and molasses, just as in commercial feedlot rations; the milo and barley came from the Midwest and the soft red winter wheat and corn were grown in Maryland.

In addition to the finishing trials, Oltjen conducted metabolism studies to more precisely establish the proportion of individual nutrients in the grain rations that were retained in the bodies of test steers.

Metabolism tests showed that the lower protein content of corn resulted in less feeding value available per pound than barley or wheat. Steers derived less digestible dry matter from the corn and were able to retain less of the protein available.

Finishing steers require about 11 percent crude protein in the ration for proper growth, and corn contains only 9 percent natural crude protein. Adding 1 percent urea to corn overcame this deficiency and made corn essentially equal in feeding value to barley or wheat.

Urea is not a protein, but rumen microbes can build protein from it. Cattle feeders frequently use urea in steer rations instead of a protein supplement because urea is considerably less expensive.

Milo has a protein content also slightly below requirements for finishing cattle, and the usual cattle feed high in milo also contains urea or a protein supplement. But adding urea to milo of the type used in Oltjen's metabolism trials did not appreciably increase the amount of protein available for body growth. The amount of digestible protein went up, but this gain was offset by greater losses through the urine.

The amount of protein in the milo ration available for body growth was about 65 percent that of barley, and the digestibility of dry matter was only about 85 percent as high, metabolism trials showed. This was true whether milo was fed with or without urea. Oltjen estimates that if he had been feeding cattle for profit he probably should have paid no more for the milo used in the studies than three-quarters the going rate for barley. This evaluation of milo is not absolute, however, Oltjen cautions.

Feeding value of different lots of milo apparently varies greatly, he says. Although trials at some State experiment stations agree with ARS findings that milo is less valuable in cattle rations than corn, other State research found milo nearly or completely as valuable.

Part of the explanation may lie in the fact that milo protein quantity and quality varies more than most other grains from one part of the country to another, even if equally good cultural practices are followed. Recent evidence from State experiment stations indicates that the feeding value of some milos can be improved by carefully controlled heat treatments and by rolling or flaking. Further research is needed to fully explain the variation in feeding value of milo.■

In metabolism trials comparing the feeding value of cracked barley, wheat, corn, and milo, ARS beef cattle nutritionist R. R. Oltjen found that wheat intrinsically is as good as barley or corn supplemented with urea. But in extended finishing trials, he found that feed intake of steers on wheat went down 18 percent after 10 weeks. Feeding at least 40 percent corn with wheat in high-concentrate rations, however, solved the problem, Oltjen says.

CRACKED CORN, WHEAT, BARLEY, AND MILO AS CATTLE FEED

Comparison	CORN		WHEAT	BARLEY	MILO	
	Without Urea	With Urea	Without Urea	Without Urea	Without Urea	With Urea
Digestibility of dry matter (%)	75.2	83.0	87.5	84.0	71.8	73.3
Nitrogen retention (%)	22.7	42.5	42.7	38.0	23.8	23.0
Crude protein of ration (%)	9.0	11.4	11.7	13.8	10.8	13.3

Mosaic Virus:

Threat to a Million Dollar Crop

A VIRUS SIMILAR to common tobacco mosaic virus causes color breaking in the flowers of Cattleya orchids, mainstay of the orchid industry.

ARS scientists have discovered that the virus, which normally affects the orchids, causes the color of the lavender flowers to break into darkly pigmented streaks and spots, making them unattractive and unsalable. The foliage of the infected orchids may have other symptoms such as brown diamond-shaped lesions or red-brown spots and streaks. Or, the plant may be infected and show none of these symptoms.

Mosaic virus is an insidious disease, and adverse effects of the virus may not show up for many months after the plant becomes infected. Infected plants, however, serve as sources for further spread of the disease by contaminating cutting tools. Good cultural practices, therefore, including sterilization of cutting tools, is essential to limit the spread of the virus. Also, new seedlings should be isolated from old plants which may be latent carriers of the virus.

Scientists are working to identify all strains of virus that affect orchids so that they can be controlled or avoided. Mosaic virus is the most serious disease of the $1 million orchid industry.

Virus infection is very serious because it can ruin an expensive plant that might normally produce flowers for over 100 years. Orchid plants are slow growing and take many years to flower from seed.

R. H. Lawson, ARS Plant Pathologist, Beltsville, Md., recently conducted tests to evaluate the effects of the orchid strain of tobacco mosaic virus on the growth and flowering of Cattleya orchids The second part of his experiment was conducted to learn whether common tobacco mosaic virus obtained from cigarette or pipe tobacco could infect the orchids.

First, he infected some 3-year-old Cattleya seedlings with the orchid strain of the virus obtained from an infected plant. Plants showed none of the obvious symptoms, but roots were undeveloped and many died. The surviving plants were stunted and produced fewer leaves than healthy plants.

Second, he isolated common tobacco mosaic virus from commercial tobaccos. All attempts made to infect Cattleya orchid seedlings with virus from these sources failed, however.■

Severe color breaking in a Cattleya orchid flower caused by the tobacco mosaic virus that affects orchids (PN–1581).

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DIVISION OF PUBLIC DOCUMENTS, WASHINGTON, D.C. 20402

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Inexpensive Lab Tool

A trip to the corner drugstore for a razor blade, a search of laboratory shelves for two 50-cent clamps, a quick assembly—and ARS biologist Murray Fisher has a time-saving device that cuts uniformly thick slices of tissue for microscopic examination.

Fisher uses the cutter frequently in his work in a human nutrition laboratory at Beltsville, Md. He not only saves time with it but gets better samples than he can get with the method normally used for this kind of work, cutting by hand with only the eye for a guide.

The single-edge razor blade is held fast between two tubing clamps commonly found in most laboratories. The tool cuts fresh or fixed tissue at 3 mm, a convenient thickness for paraffin or gelatin embedding. Thicker slices can be cut by placing cardboard or metal shims between the bottom of the razor blade and the clamps.

Holding the tissue on a flat surface such as a smooth wooden block, Fisher moves the cutter across the tissue with a slight back-and-forth motion. He cuts large diameter pieces to the center, reverses the tissue, and then cuts it from the other side. There is virtually no ridge where the cuts meet.

Biologist Fisher's device is a good example of what one can do with inexpensive or on-hand items to make one's job a little simpler.

Pure Culture Olives

The old, troublesome method of fermenting green, Spanish-style olives on a large scale by processing them in wood barrels and casks for 2 to 12 months may be a thing of the past.

A process, originally developed to improve cucumber pickles, called the pure culture, controlled fermentation process, has been successfully applied to Manzanillo olives by ARS researchers and other cooperating scientists at Raleigh, N.C. The process consists of inoculating consumer and institutional-sized containers of olives with a pure culture of lactic-acid producing bacteria. This assures a successful normal fermentation, produces Spanish-style olives of uniform quality, and virtually eliminates spoilage losses that often occur in large-scale fermentation.

The new process may mean lower production costs for the processor because he can pack the olives directly into consumer containers. This, together with the other advantages of assured fermentation and uniform flavor and quality, should encourage an increase in the domestic processing of Spanish-style olives with a resultant increase in domestic olive production.

Americans consume about 85 million pounds of Spanish-style olives annually. Partly because Manzanillo olives are hard to ferment, only 8 million of the 107-million-pound annual olive production goes into Spanish-style olives. The remainder goes into other olive products, mainly mildly salted, unfermented black California-style olives.

The process was developed by microbiologist J. L. Etchells and research food technologist H. A. Fleming, research biochemist T. A. Bell of ARS; A. F. Borg, of Kansas State University, Manhattan, and I. D. Kittel, of M. A. Gedney Co., Chaska, Minn.

A chemist draws fluid from an experimental pack of domestic olives inoculated with a pure culture of lactic acid-producing bacteria (PN–1573).

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

U.S. GOVERNMENT PRINTING OFFICE: 1967